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Three new species of *Macrophya* Dahlbom (Hymenoptera, Tenthredinidae) with a key to species of the *Macrophya imitator* group in China

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Abstract

The *Macrophya imitator* group was proposed by Liu et al. in 2015. Three new species, *Macrophya longlingensis* **sp. nov.**, *M. nieshuaiguoi* **sp. nov.** and *M. zejiani* **sp. nov.** from China are described. A key to all Chinese species and a geographical distribution map of the *M. imitator* group in China are provided.

Key Words

Hymenoptera, *Macrophya imitator* group, Sawflies, taxonomy, Tenthredinoidea

Introduction

Macrophya Dahlbom, 1835 is the third largest genus in the subfamily Tenthredininae (Hymenoptera, Tenthredinidae). It contains 306 species worldwide, of which 167 have been recorded for China up to April 2019 (Li et al. 2019a, 2019b; Liu et al. 2019a, 2019b). The taxonomy and distribution of the genus in China has been studied by the last author and his co-workers since 1994 and a division of *Macrophya* in species groups was given by Liu et al. (2015, 2018, 2019b).

The *Macrophya imitator* group is the second largest species group in *Macrophya*, with 17 species worldwide, all of which are present in China. Among them, *M. imitator* Takeuchi is also distributed in Japan, Korea and Russia (Takeuchi 1937), and *M. postscutellaris* Malaise in Myanmar (Malaise 1945). The species of the *Macrophya imitator* group are all similar in general morphology and constitute a clearly defined species group in *Macrophya*. In this study, three new species belonging to this species group are described from China, namely: *M. longlingensis* Li, Liu & Wei, sp. nov., *M. nieshuaiguoi* Li, Liu & Wei, sp. nov. and *M. zejiani* Liu & Wei, sp. nov. A key to all species found in China is provided.

Materials and methods

All specimens of the newly described species were obtained by sweeping in wooded bog and forest fringe zones in Yunnan Province (southern China) from 1994 to present. Eight specimens of three new species and 788 specimens of known species were examined and studied

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for this work. The specimens were examined with a Motic-SMZ-171 stereomicroscope. Images of the imagines were taken with a Nikon D700 digital camera and a Leica Z16APO. The genitalia were examined with a Motic BA410E microscope and photographed with Motic Moticam Pro 285A. Images were focus-stacked using Helicon Focus (HeliconSoft, Kharkiv, Ukraine) and further processed with Adobe Photoshop CS 11.0.

The terminology of genitalia follows Ross (1945) and that of general morphology follows Viitasaari (2002). For a few terms (e.g. middle fovea and lateral fovea), we follow Takeuchi (1952).

All types are deposited in the Insect Collection of Central South University of Forestry and Technology, Changsha, Hunan, China (**CSCS**).

Abbreviations:

OCL The distance between a lateral ocellus and the occipital carina, or the hind margin of the head where this carina would be if it were developed (Benson 1954).

OOL The shortest distance between an eye and a lateral ocellus.

POL The distance between the mesal margins of the two lateral ocelli.

Results

Macrophya imitator species group

Remarks. The *Macrophya imitator* group is morphologically very similar to the *M. maculitibia* group, a diagnosis to which was provided by Li et al. (2019b). Species of the *M. imitator* group can be recognized using the diagnosis provided by Liu et al. (2015), here restated: the body mainly black, without metallic tinge; the antenna slender and black; the posterior margin of metepimeron straight or slightly concave, the appendage (= posterior corner of metepimeron) differentiated but not elongated, at least partly punctate and evenly pilose, without basin; the abdominal tergum 1 not reticulate and the penis valve oval, narrowed toward apex, ergot short.

Description. Body slender and mainly black, without metallic tinge; white maculae to varying extents on pronotum, hind trochanter and dorsal surface of hind tibia subapically; fore wing without smoky macula below pterostigma; clypeus at its greatest breadth slightly broader than the shortest distance between lower inner orbits of eyes; lateral margins convergent anteriorly, anterior margin incised to approximately 1/5–1/3 length of clypeus, apex of lateral lobe obtuse; malar space narrower than diameter of an ocellus; postocellar area broader than long; vertex with minute and dense punctures, interspaces between punctures narrow usually; antenna slender and black, antennomere 3 clearly longer than antennomere 4; posterior margin of metepimeron straight or slightly concave, appendage (posterior corner of metepimeron) differentiated but not elongated, at least partly punctate and evenly pilose, without basin; inner spur of hind leg slightly longer than half length of metabasitarsus, metabasitarsus always slender, slightly longer than following four tarsomeres together; claw with inner tooth slightly shorter than outer tooth; abdominal tergum 1 not reticulate; penis valve oval, narrowed towards apex, ergot short.

Key to the Chinese species of the *Macrophya imitator* group

1 Female 2
– Male 21
2 Ovipositor sheath much longer than middle tibia 3
– Ovipositor sheath clearly shorter than middle tibia 5
3 Posterior margin of pronotum with narrow white band; dorsal surface of hind tibia with a large white macula subapically. China (Beijing, Gansu, Hebei, Henan, Hubei, Ningxia, Qinghai, Shaanxi, Shanxi, Sichuan) ..... *M. weni* Wei, 1998
– Pronotum entirely black; dorsal surface of hind tibia with a subapical white macula smaller than above 4
4 Postocellar area 2.5× broader than long; POL: OOL: OCL = 4.5: 10: 5.5 (Figure 3B); antennomere 3 approximately 1.4× longer than antennomere 4 (13: 9) (Figure 3D); distance between cenchri twice breadth of a cenchrus; middle serrulae with 2 or 3 proximal and 9 or 10 distal teeth (Figure 3H); cell 2Rs as long as cell $1R_1$, petiole of anal cell in hind wing 0.6× as long as cross-vein cu-a (Figure 3A). China (Yunnan) ..... *M. zejiani* Liu & Wei, sp. nov.
– Postocellar area twice broader than long; POL: OOL: OCL = 3: 10: 7; antennomere 3 approximately 1.8× longer than antennomere 4 (11: 6); distance between cenchri 2.5× breadth of a cenchrus; middle serrulae with 2 proximal and 9–12 distal teeth; cell 2Rs clearly shorter than cell $1R_1$, petiole of anal cell in hind wing only slightly shorter than cross-vein cu-a. China (Sichuan) ..... *M. omeialpina* Li, Jiang & Wei, 2018
5 Apex of middle tibia with a distinct white macula on dorsal surface; punctures on middle part of mesepisternum minute, much smaller than punctures on vertex 6
– Apex of middle tibia without white macula on dorsal surface, but sometimes with a white spot or stripe on anterior surface; punctures on middle part of mesepisternum about as large as or somewhat smaller than punctures on vertex 12
6 Hind trochanter entirely white 7
– Hind trochanter partly white, with a distinct black macula 8

7 Ovipositor sheath longer than fore tibia, with lateral setae very short, not distinctly curved; middle serrulae with 20 fine distal teeth. China (Henan, Hubei, Hunan, Shaanxi) ..... *M. flactoserrula* Chen & Wei, 2002
– Ovipositor sheath shorter than fore tibia, with lateral setae long and curved; middle serrulae with 10–12 distal teeth. China (Gansu, Henan, Hubei, Shaanxi)..... *M. funiushana* Wei, 1998
8 Pronotum entirely black 9
– Posterior margin of pronotum white 10
9 Postocellar area 1.7× broader than long; fore and middle trochanters entirely black; hind trochanter entirely black; subapical white macula on dorsal surface of hind tibia about 2/5 length of tibia; posterior margin of metepimeronal appendage with a distinct shiny and obtuse carina toward the longitudinal axis of body; ovipositor sheath as long as fore tibia; the middle serrulae with 13–16 distal teeth. China (Jilin, Shaanxi) ..... *M. bui* Wei & Li, 2012
– Postocellar area twice broader than long; fore and middle trochanters largely black; hind trochanter largely white, ventral surface with black macula; subapical white macula on dorsal surface of hind tibia shorter than 1/3 length of tibia; the inner side of metepimeronal appendage without a shiny and obtuse carina; ovipositor sheath distinctly longer than fore tibia; lancet oblique and weakly protruding, with several larger teeth, the middle serrulae with 5–7 distal teeth. China (Gansu, Hebei, Henan, Jilin, Liaoning, Ningxia, Shaanxi, Shanxi)..... *M. parimitator* Wei, 1998
10 Hind tibia with broad white ring at mid-length, as long as half length of hind tibia. China (Shaanxi)..... ..... *M. circulotibialis* Li, Liu & Heng, 2015
– Hind tibia with subapical white macula shorter than half length of hind tibia..... 11
11 Abdominal tergum 1 entirely black, posterior margin without white macula; middle serrulae each with 1 or 2 proximal and 14 or 15 distal teeth, subbasal teeth small. China (Jilin) ..... *M. changbaina* Li, Liu & Heng, 2015
– Posterior margin of abdominal tergum 1 with 2 small, distinct and white maculae; middle serrulae flat, middle serrulae each with 2 proximal and 15–18 distal teeth, subbasal teeth minute. China (Jilin, Ningxia)..... ..... *M. curvatitheca* Li, Liu & Heng, 2015
12 Punctures on head and mesepisternum clearly defined, equal in size, interspaces strongly shiny; punctures on metepimeronal appendage clearly separated; hind tibia with white macula as long as half length of hind tibia. Myanmar; China (Chongqing, Guizhou, Hubei, Shaanxi, Tibet) ..... *M. postscutellaris* Malaise, 1945
– Punctures on mesepisternum smaller than punctures on head, punctures crowded on both, interspaces very fine, partly obscure, less shiny; punctures on metepimeronal appendage hardly separated; hind tibia with subapical white macula distinctly shorter than half length of hind tibia..... 13
13 Frons distinctly convex and extending above top of eyes; posterior 1/3 of abdominal tergum 1 with white bands across its full breadth. China (Sichuan) ..... *M. kangdingensis* Wei & Li, 2012
– Frons flat and not extending above top of eyes; posterior margin of abdominal tergum 1 with very narrow white band, or with 2 small transverse white maculae..... 14
14 Posterior margin of pronotum white 15
– Pronotum entirely black 16
15 Setae on ovipositor sheath short and straight in dorsal view; posterior margin of metepimeronal appendage without glabrous patch; middle serrulae with 9 or 10 fine distal teeth; annular spine bands narrow and remaining distant from each other. China (Gansu, Guizhou, Hubei, Hunan, Shaanxi, Sichuan) ..... *M. imitatoides* Wei, 2007
– Setae on ovipositor sheath long and evenly curved in dorsal view; posterior margin of metepimeronal appendage with a distinct glabrous patch; middle serrulae with 5 or 6 fine distal teeth; annular spine bands broadly meeting each other. China (Gansu, Hubei, Ningxia, Shaanxi, Sichuan)..... *M. curvatisaeta* Wei & Li, 2011
16 Hind trochanter entirely black..... 17
– Ventral surface of hind trochanter with black macula..... 18
17 Postocellar area 1.7× broader than long; subapex in dorsal surface with a clear white macula; middle serrulae with 2 proximal and 5 or 6 distal teeth. Korea, Japan, Russia (East Siberia); China (Heilongjiang, Jilin, Liaoning)..... ..... *M. imitator* Takeuchi, 1937
– Postocellar area twice broader than long (Figure 2B); hind tibia with subapical white macula on dorsal surface weak (Figure 2A); middle serrulae with 2 proximal and 7–10 distal teeth (Figure 2H). China (Yunnan) .... *M. nieshuaiguoi* Li, Liu & Wei, sp. nov.
18 Ventral surface of hind trochanter with a large, distinct black macula 19
– Ventral surface of hind trochanter with a small, weak black macula 20
19 Postocellar area 2.2× broader than long; white band at center of posterior margin of abdominal tergum 1 narrow; subapical white macula on dorsal surface of hind tibia indistinct; petiole of anal cell in fore wing slightly shorter than vein 1r-m, about half length of vein cu-a; middle serrulae of lancet each with 2 proximal and 7 or 8 distal teeth, cypsella between the 8^{th}–9^{th} serrulae slightly broader than length of the 9^{th} serrula. China (Sichuan) .... *M. semipunctata* Li, Liu & Wei, 2018
– Postocellar area 2.5× broader than long; white band at center of posterior margin of abdominal tergum 1 broader than the former; subapical white macula on dorsal surface of hind tibia distinct and small, but oblique; petiole of anal cell in fore wing twice length of vein 1r-m, and about as long as vein cu-a; middle serrulae each with 2 proximal and 5–7

distal teeth, cypsella between the 8th–9th serrulae as broad as length of the 9th serrula. China (Gansu, Ningxia, Shaanxi, Sichuan) ..... *M. nigromaculata* Wei & Li, 2010

20 Anterior margin of clypeus incised to approximately 1/3 its length (Figure 1C); middle serrulae with 2 proximal and 8–11 distal teeth (Figure 1H); petiole of anal cell in hind wing as long as cross-vein cu-a (Figure 1A). China (Yunnan)... ..... *M. longlingensis* Li, Liu & Wei, sp. nov.

– Anterior margin of clypeus incised to approximately 1/5 its length; middle serrulae with 2 proximal and 5–7 distal teeth; petiole of anal cell in hind wing 0.5× longer than cross-vein cu-a. China (Hubei, Jilin, Shaanxi) .... *M. jiaozhaoae* Wei & Zhao, 2011

21 Hairs on abdominal terga erect, approximately as long as diameter of middle ocellus; anterior margin of valviceps somewhat acute ..... *M. weni* Wei, 1998

– Hairs on abdominal terga oblique, much shorter than diameter of middle ocellus; anterior margin of valviceps more or less evenly rounded 22

22 Hind tibia with a white macula extending over approximately half its length 23

– Hind tibia with a white macula clearly shorter than half its length 24

23 Hind tibia with a broad, white ring about its mid-length; all trochanters mostly black; white macula on posterior margin of pronotum broad; valviceps slightly narrowed toward apex, ergot long below ..... *M. circulotibialis* Li, Liu & Heng, 2015

– Hind tibia with a white macula dorsally, but not forming; all trochanters entirely white; white macula on posterior margin of pronotum narrow; valviceps not narrowed toward apex, ergot short above ..... *M. postscutellaris* Malaise, 1945

24 Fore and middle trochanters mostly to entirely black 25

– Fore and middle trochanters entirely white 29

25 Hind trochanter mostly to entirely black 26

– Hind trochanter entirely white 28

26 Hind trochanter entirely black; pronotum entirely black ..... *M. bui* Wei & Li, 2012

– Hind trochanter mostly black, marginal parts white; posterior margin of pronotum with white band more or less 27

27 Posterior margin of pronotum with broad white band; hind tibia with a distinct dorsal white macula; ergot of pennis valve long below ..... *M. curvatitheca* Li, Liu & Heng, 2015

– Posterior margin of pronotum with narrow white band; hind tibia with dorsal white macula weak or distinct; ergot of penis valve short above ..... *M. nigromaculata* Wei & Li, 2010

28 White band in posterior margin of pronotum narrow but distinct; interspaces between punctures on vertex as broad as diameter of a puncture; valvula of penis valve not broadened toward apex ..... *M. imitatoides* Wei, 2007

– Posterior margin of pronotum entirely black; interspaces between punctures on vertex narrower than diameter of a puncture; valvula of penis valve clearly broadened toward apex ..... *M. imitator* Takeuchi, 1937

29 Labrum and clypeus entirely white 30

– Labrum largely black and clypeus entirely black 32

30 Punctures on vertex large; ventral surface of hind femur black, without white band; valviceps approximately 2.3× longer than broad ..... *M. kangdingensis* Wei & Li, 2012

– Punctures on vertex minute; ventral surface of hind femur with distinct white band; valviceps clearly 1.4–1.7× longer than broad 31

31 White band on posterior margin of abdominal tergum 1 very narrow; entire posterior margin of pronotum with narrow white macula; sterna of abdomen entirely black ..... *M. flactoserrula* Chen & Wei, 2002

– White band submedially on posterior margin of abdominal tergum 1 approximately 2/5 of its breadth clearly; posterior margin of pronotum with a distinct, broad white macula; sterna of abdomen largely white ..... *M. funiushana* Wei, 1998

32 White band at posterior margin of pronotum distinct ..... *M. curvatisaeta* Wei & Li, 2011

– White band at posterior margin of pronotum weak or indistinct ..... *M. jiaozhaoae* Wei & Zhao, 2011

Macrophya longlingensis Li, Liu & Wei, sp. nov.

http://zoobank.org/6129209F-9628-4C4B-9CBC-F5B241B25A4F

Figure 1

Diagnosis. The new species is morphologically similar to *M. parimitator* Wei, 1998 in body and legs mainly black; antennae rather robust, middle antennomeres not inflated; anterior margin shallowly incised to approximately 1/3 its length, lateral corners somewhat short and broad; malar space linear, approximately 0.5× as broad as diameter of middle ocellus; lancet narrow and long, with 20 serrulae; but differs from the latter in having vertex shiny; frontal area coarsely and densely punctured, with smooth interspaces between punctures distinct; anterior 1/6 of katepimeron very smooth and shiny, without punctures or microsculpture, posterior 5/6 with some shallow large punctures, microsculpture indistinct; dorsal surface of middle tibia black, without white macula subapically; dorsal surface of hind tibia with a small, narrow white macula; cell 2Rs of fore wing clearly shorter than cell $1R_1$, petiole of anal cell in hind wing as long as cross-vein cu-a; middle serrulae with 2 proximal and 8–11 distal teeth, subbasal teeth clear and small. The new species is also morphologically similar to *M. jiaozhaoae* Wei & Zhao, 2011 in body and legs mainly black; antennae

rather robust, middle antennomeres not inflated; ventral surface of hind trochanter with a small, weak black macula; pronotum entirely black; fronts flat and not extending above top of eyes; hind tibia with subapical white macula distinctly shorter than half length of hind tibia; ovipositor sheath clearly shorter than middle tibia; but differs from the latter in having anterior margin of clypeus incised to approximately 1/3 its length; middle serrulae with 2 proximal and 8–11 distal teeth; petiole of anal cell in hind wing as long as cross-vein cu-a.

Description. Holotype: female. Body length 7 mm. Body and legs black; following parts pale brown: palp mostly, a small triangular macula on apical margin of clypeus, ventral surface of fore tarsomere mostly; following parts white: basal half of mandibles, transverse macula submedially on posterior margin of abdominal tergum 1, apical margins of all coxae, apical margins of fore and middle trochanters, hind trochanter except for ventral surface with a small black macula, apex of fore and middle femora anteriorly, anterior surface of middle tibia, hind tibia with long, narrow subapical macula on dorsal surface. Body hairs short and dense, silver; setae on ovipositor sheath slightly long and curved, blackish brown. Wings hyaline, without smoky macula, pterostigma and veins mostly blackish brown (Figure 1A).

Vertex shiny; frontal area coarsely and densely punctured clearly, smooth interspaces distinct and smooth; interspaces of postocellar area with small areas and some large punctures, interspaces distinct and without microsculpture (Figure 1B); labrum and clypeus less shiny, punctures on labrum sparse, punctures on clypeus denser, microsculpture weak (Figure 1C). Mesonotum less shiny, punctures on mesonotum smaller and denser than punctures on head, interspaces distinct and smooth; center of mesoscutellum with some large punctures, interspaces broad, marginal area with denser punctures than center; mesoscutellar appendage mostly and metascutellum entirely smooth and shiny, but bottom of mesoscutellar appendage with weak microsculpture and without distinct punctures. Mesopleuron less shiny, mesepisternum with dense and coarse punctures, upper half with punctures large and interspaces broad, lower half with punctures small and interspaces narrow; anepimeron dull, with coarse wrinkles; anterior 1/6 of katepimeron very smooth and shiny, without punctures or microsculpture, posterior 5/6 of katepimeron with some shallow large punctures, dorsal half with some deep punctures; metepisternum dull, with minute punctures, microsculpture distinct; metepimeron less shiny, depressed area with some punctures and weak microsculpture; metepimeronal appendage platform-shaped, with some minute punctures (Figure 1E). All abdominal terga shiny, laterally abdominal tergum 1 with some shallow punctures, nearly smooth submedially; other abdominal terga less shiny, anterior 2/3 with some shallow punctures and weak microsculpture, posterior 1/3 smooth. Outer surface of hind coxa with somewhat dense and coarse punctures, outer surface of hind femur with sparse shallow punctures and fine microsculpture. Surface of ovipositor sheath coriaceous, with indistinct punctures and fine microsculpture.

Labrum elevated medially, anterior margin slightly truncate; clypeus weakly elevated, base slightly broader than distance between lower inner orbits of eyes, lateral sides distinctly convergent apically, anterior margin shallowly incised to approximately 1/3 its length, lateral corners somewhat short and broad, lobe margin subtriangular (Figure 1C); malar space linear, approximately 0.5× as broad as diameter of middle ocellus; frontal area and face flat, slightly higher than top of eyes in lateral view; middle fovea weak, pot-shaped, lateral foveae clear, short furrow-like; interocellar furrow shallow, postocellar furrow weak; POL: OOL: OCL = 8: 12: 9; postocellar area weakly elevated, approximately 2.2× broader than long; lateral furrow somewhat broad and shallow, divergent posteriorly; head narrowed behind eyes in dorsal view, occipital carina complete. Antenna rather robust, approximately 1.1× longer than head and thorax together (16: 15), approximately as long as abdomen; antennomere 2 approximately 1.3× as long as breadth; antennomere 3 approximately 1.5× as long as antennomere 4 (43: 29), approximately 0.8× as long as antennomeres 4 and 5 together (43: 55), middle antennomeres not inflated, subapical antennomeres weakly compressed (Figure 1D). Mesoscutellum elevated, without median ridge or carina, as high as top of mesonotum in lateral view; mesoscutellar appendage with acute middle longitudinal carina; metascutellum with short and low carina; posterodorsal platform of mesepimeron as broad as diameter of middle ocellus; metepimeronal appendage small platform-shaped; distance between cenchri 2.5× breadth of a cenchrus; mesopleuron and metapleuron as shown in Figure 1E. Inner tibial spur of hind leg 0.6× length of metabasitarsus (20: 33); metabasitarsus slender, about 1.1× longer than following four tarsomeres together (11: 10); claw with inner tooth slightly shorter than outer tooth. Ovipositor sheath slightly shorter than metabasitarsus (10: 11), apical sheath longer than basal sheath (3: 2), setae on ovipositor sheath slightly curved and long in dorsal view, apical margin round in lateral view (Figure 1F). Fore wing with cross-vein cu-a joining cell 1M in basal 1/3, cross-vein 2r joining cell 2Rs in apical 1/5, cell 2Rs clearly shorter than cell $1R_1$, petiole of anal cell twice longer than cross-vein 1r-m and as long as cross-vein cu-a; petiole of anal cell in hind wing as long as cross-vein cu-a. Lancet narrow and long, with 20 serrulae (Figure 1G), serrulae slightly protruding and oblique, middle serrulae with 2 proximal and 8–11 distal teeth, subbasal teeth distinct and small, annular spine bands somewhat broad, the 7^{th}–9^{th} serrulae as shown in Figure 1H.

Male. Unknown.

Type material. Holotype, ♀, China: Yunnan Province: Longling County, Mount Xiaohei, 24°41.713'N, 98°45.574'E, 2010 m, 2.vi.2009, leg. Zejian Li, ethylac-

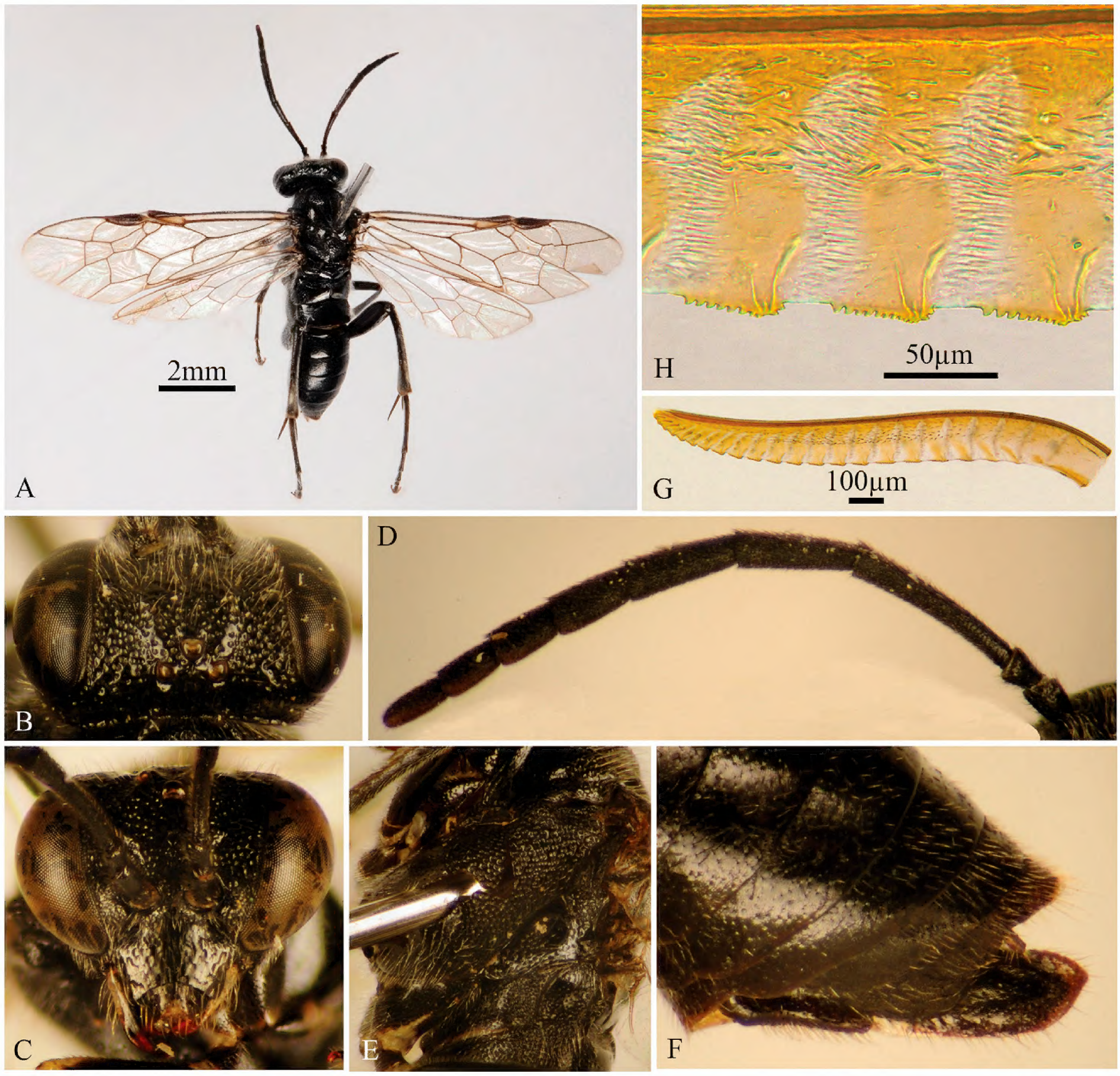

Figure 1. *Macrophya longlingensis* sp. nov., ♀, holotype. **A.** Female adult, dorsal view; **B.** Head of female, dorsal view; **C.** Head of female, frontal view; **D.** Antenna of female, lateral view; **E.** Mesopleuron and metapleuron of female; **F.** Ovipositor sheath, lateral view; **G.** Lancet; **H.** The 7th–9th serrulae. Scale bars: 2 mm (A); 100 μm (G); 50 μm (H).

etate. **Paratypes**, 1♀, same data, but leg. Gengyun Niu; 2♀, Yunnan Province: Longling County, Mount Gaoligong, 24°49.700'N, 98°46.062'E, 2145 m, 2.vi.2009, leg. Yihai Zhong, ethylacetate; 1♀, Yunnan Province: Yunlong County, Mount Daoren, 25°32.893'N, 99°11.267'E, 2265 m, 3.vi.2009, leg. Gengyun Niu, ethylacetate; 1♀, Yunnan Province: Lushui County, Yaojiaping, 25°975'N, 98°710'E, 2550 m, 3.vi.2009, leg. Wei Xiao, ethylacetate.

Host plants. Unknown.

Distribution. China (Yunnan).

Etymology. The specific name "*longlingensis*" is derived from Longling County (Yunnan Province) where the holotype was collected.

***Macrophya nieshuaiguoi* Li, Liu & Wei, sp. nov.**

http://zoobank.org/DC7F944E-39C9-4E30-A022-F33927E38791

Figure 2

Diagnosis. The new species is morphologically similar to *M. jiaozhaoae* Wei & Zhao, 2010 in body and legs mainly black; antennae rather robust, middle antennomeres not inflated; lancet narrow and long, serrulae slightly protruding and oblique; hind tibia with subapical white macula distinctly shorter than half length of hind tibia; ovipositor sheath clearly shorter than middle tibia; but differs from the latter in having vertex less shiny, interspaces of postocular area and postocellar area with some large punctures, interspaces between punctures distinct; anterior margin of clypeus deeply incised to approximately 2/5 its length; postocellar area about 1.6× broader than long; posterior margin

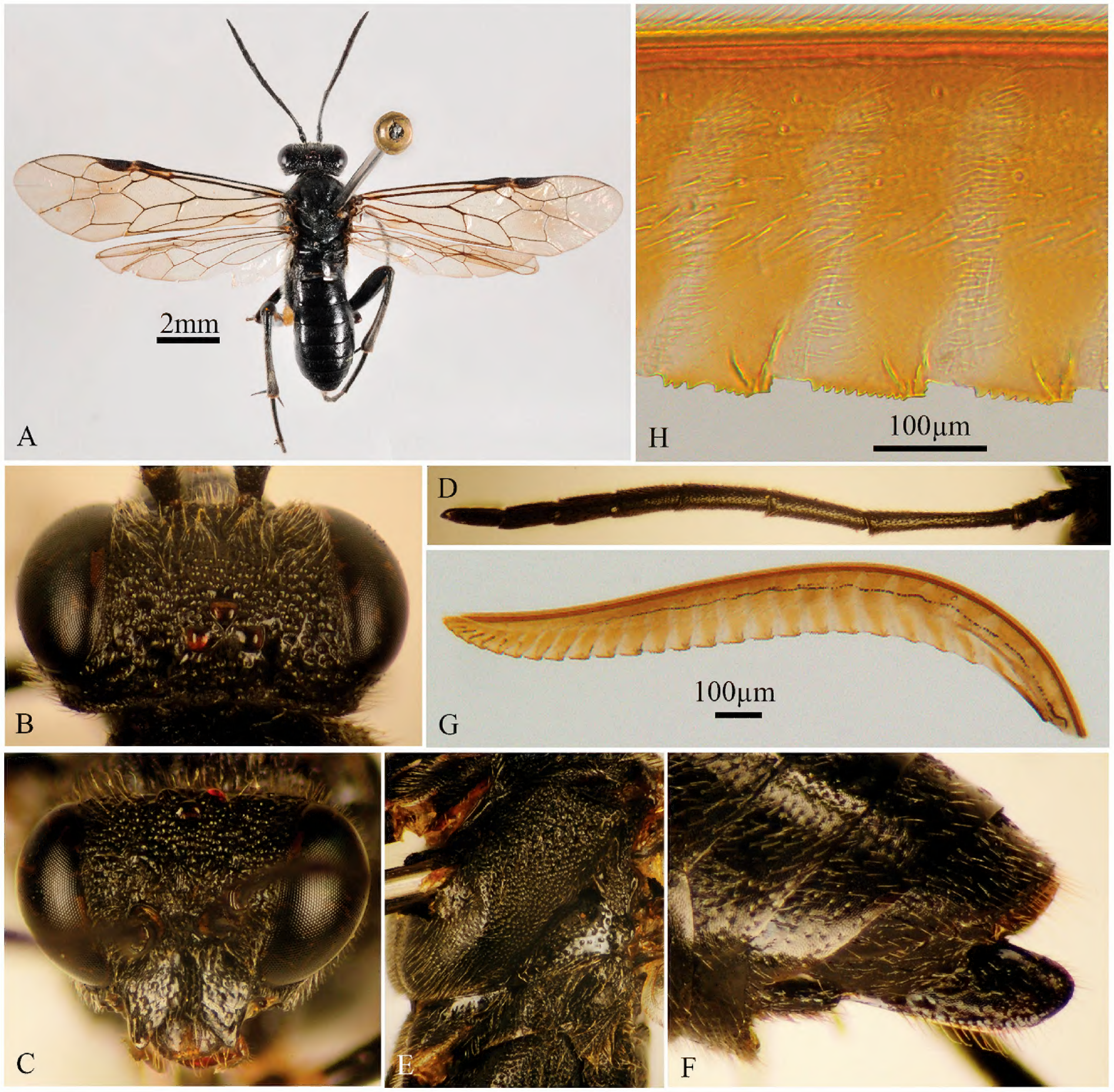

Figure 2. *Macrophya nieshuaiguoi* sp. nov., ♀, holotype. **A.** Female adult, dorsal view; **B.** Head of female, dorsal view; **C.** Head of female, frontal view; **D.** Antenna of female, lateral view; **E.** Mesopleuron and metapleuron of female; **F.** Ovipositor sheath, lateral view; **G.** Lancet; **H.** The 8th–10th serrulae. Scale bars: 2 mm (A); 100 μm (G, H).

of abdominal tergum 1 with broad white band; petiole of anal cell in fore wing shorter than cross-vein cu-a, petiole of anal cell in hind wing as long as cross-vein cu-a; setae on ovipositor sheath slightly curved and sparse in dorsal view; middle serrulae with 2 proximal and 7–10 distal teeth. The new species is also morphologically similar to *M. imitator* Takeuchi, 1937 in body and legs mainly black; antennae rather robust, middle antennomeres not inflated; pronotum and hind trochanter entirely black; but differs from the latter in having postocellar area twice broader than long; hind tibia with subapical white macula on dorsal surface weak; middle serrulae with 2 proximal and 7–10 distal teeth.

Description. Holotype: female. Body length 8 mm. Body and legs black; palp mostly blackish brown; a small triangular macula on apical margin of clypeus pale brown; following parts white: basal half of mandibles, broad band on posterior margin of abdominal tergum 1 submedially, apical margins of fore and middle coxae, their outer surfaces with some longitudinal stripes, apical margin of hind coxa, fore and middle trochanters narrowly, hind trochanter entirely, anterior surface of fore and middle femora apically, anterior surface of fore tibia, hind tibia with small dorsal macula subapically; ventral surfaces of fore and middle tarsomeres mostly pale brown to pale blackish brown. Body hairs short and dense, silver; setae on ovipositor sheath slightly long and curved, blackish brown. Wings hyaline, without smoky macula, pterostigma and veins mostly blackish brown (Figure 2A).

Vertex less shiny; frontal area coarsely and densely punctured, interspaces smooth and narrow; interspaces of postocular area and postocellar area with sparse large punctures, interspaces between punctures distinct (Figure 2B); labrum and clypeus less shiny, labrum and clypeus with sparse shallow large punctures, microsculpture distinct; punctures on labrum shallow, punctures on clypeus denser toward apex (Figure 2C). Mesonotum less shiny, punctures smaller than those on head, interspaces smooth but indistinct and without microsculpture; center of mesoscutellum with sparse large punctures, interspaces broad, marginal area with dense punctures than center; mesoscutellar appendage somewhat shiny, with sparse minute punctures and weak microsculpture; metascutellum somewhat shiny, with punctures indistinct and microsculpture weak. Mesopleuron less shiny, mesepisternum with dense and coarse punctures, upper half with punctures large and interspaces broad, lower half with punctures small and interspaces narrow; anepimeron dull, with coarse wrinkles; anterior 1/5 of katepimeron very smooth and shiny, without punctures or microsculpture, posterior 4/5 of katepimeron with some large shallow punctures, dorsal half with sparse coarse punctures; metepisternum dull, with minute punctures, microsculpture clear; metepimeron less shiny, depressed area with sparse punctures and weak microsculpture; metepimeronal appendage platform-shaped, with sparse minute punctures (Figure 2E). All abdominal terga somewhat shiny, two lateral sides of abdominal tergum 1 with sparse shallow punctures, central parts with fine but distinct microsculpture; other abdominal terga less shiny, anterior 3/5 of abdominal terga 2–8 with sparse shallow punctures, posterior 2/5 of abdominal terga 2–8 with weak microsculpture. Outer surface of hind coxa with somewhat dense and coarse punctures, outer surface of hind femur with some shallow punctures and fine microsculpture. Surface of sheath coriaceous, with indistinct punctures and fine microsculpture.

Labrum elevated medially, anterior margin slightly truncate; clypeus weakly elevated, base slightly broader than distance between lower inner orbits of eyes, lateral sides distinctly convergent apically, anterior margin deeply incised to approximately half its length, lateral corners short and broad, lobe margin roundly subtriangular (Figure 2C); malar space linear, approximately 0.6× as broad as diameter of middle ocellus; frontal area and face flat, as high as top of eyes in lateral view; middle fovea weak, lateral foveae shallow, short furrow-like; interocellar furrow shallow, postocellar furrow weak; POL: OOL: OCL = 7: 20: 13; postocellar area weakly elevated, approximately twice as broad as long; lateral furrow somewhat narrow, divergent posteriorly; head narrowed behind eyes in dorsal view, occipital carina complete. Antenna rather robust, approximately 1.3× longer than head and thorax together (4: 3), approximately 1.2× longer than abdomen (20: 17); antennomere 2 approximately 1.2× as long as breadth; antennomere 3 approximately 1.4× as long as antennomere 4 (33: 23), approximately 0.75× as long as antennomeres 4 and 5 together (33: 44), middle antennomeres not inflated, subapical antennomeres weakly compressed (Figure 2D). Mesoscutellum elevated roundly, without median ridge or carina, as high as top of mesonotum in lateral view; mesoscutellar appendage with slightly acute middle longitudinal carina; metascutellum with short and low carina; posterodorsal platform of mesepimeron as broad as diameter of middle ocellus; metepimeronal appendage small platform-shaped; distance between cenchri 2.2× breadth of a cenchrus; mesopleuron and metapleuron as shown in Figure 2E. Inner tibial spur of hind leg 0.6× length of metabasitarsus (3: 5); metabasitarsus slender, about 1.3× longer than following four tarsomeres together (5: 4); claw with inner tooth slightly shorter than outer tooth. Ovipositor sheath shorter than metabasitarsus (31: 45), apical sheath clearly longer than basal sheath (20: 11), setae on ovipositor sheath slightly curved in dorsal view, apical margin round in lateral view (Figure 2F). Fore wing with cross-vein cu-a joining cell 1M in basal 1/3, cross-vein 2r joining cell 2Rs in apical 1/3, cell 2Rs clearly slightly shorter than cell $1R_1$, petiole of anal cell 1.5× longer than cross-vein 1r-m and slightly shorter than cross-vein cu-a; petiole of anal cell in hind wing as long as cross-vein cu-a. Lancet narrow and long, with 24 serrulae (Figure 2G), serrulae slightly protruding and oblique, middle serrulae with 2 proximal and 7–10 distal teeth, subbasal teeth distinct and small, annular spine bands somewhat narrow, the 8^{th}–10^{th} serrulae as shown in Figure 2H.

Male. Unknown.

Type material. Holotype, ♀, China: Yunnan Province: Liuku County, Pianma, Yakou, 25°58.21'N, 98°41.06'E, 3138 m, 19.vii. 2008, leg. Shuaiguo Nie, ethylacetate.

Host plants. Unknown.

Distribution. China (Yunnan).

Etymology. The specific name "*nieshuaiguoi*" is derived from the name of Mr. Shuaiguo Nie for collecting the holotype of this new species.

Macrophya zejiani Liu & Wei, sp. nov.

http://zoobank.org/1528F16E-8F84-4FE3-9682-60D4733E2A20

Figure 3

Diagnosis. The new species is morphologically similar to *M. weni* Wei, 1998 in body and legs mainly black; antennae rather robust, middle antennomeres not inflated; ovipositor sheath much longer than middle tibia; but differs from the latter in having postocellar area twice as broad as long; pronotum entirely black; distance between cenchri twice breadth of a cenchrus; middle serrulae with 2 or 3 proximal and 9 or 10 distal teeth; fore wing below pterostigma with slightly smoky and ill-defined maculae. The new species is also morphologically similar to *M. omeialpina* Li, Jiang & Wei, 2018 in body and legs mainly black; antennae rather robust, middle antennomeres

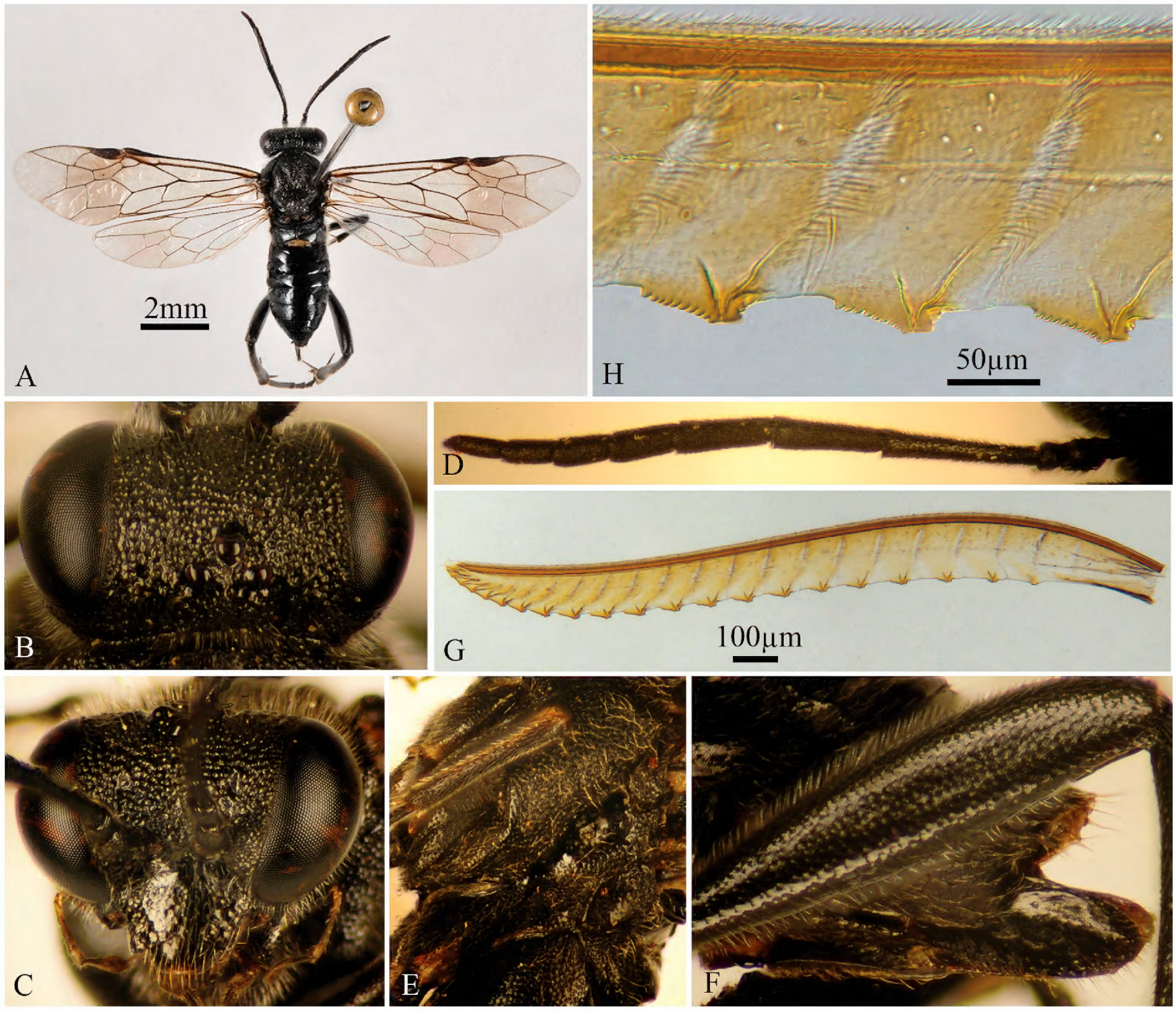

Figure 3. *Macrophya zejiani* sp. nov., ♀, holotype. **A.** Female adult, dorsal view; **B.** Head of female, dorsal view; **C.** Head of female, frontal view; **D.** Antenna of female, lateral view; **E.** Mesopleuron and metapleuron of female; **F.** Ovipositor sheath, lateral view; **G.** Lancet; **H.** The 8th–10th serrulae. Scale bars: 2 mm (A); 100 μm (G); 50 μm (H).

not inflated; pronotum entirely black; dorsal surface of hind tibia with a subapical white macula smaller than *M. weni*; but differs from the latter in having postocellar area 2.5× broader than long; POL: OOL: OCL = 4.5: 10: 5.5; antennomere 3 approximately 1.4× as long as antennomere 4 (13: 9); distance between cenchri twice breadth of a cenchrus; middle serrulae with 2 or 3 proximal and 9 or 10 distal teeth; cell 2Rs as long as cell $1R_1$, petiole of anal cell in hind wing 0.6× as long as cross-vein cu-a.

Description. Holotype: female. Body length 7.5 mm. Body and legs black; a small triangular macula in anterior margin of clypeus pale brown; following parts white: basal half of mandibles, narrow band on posterior margin of abdominal tergum 1 submedially, apical margins of fore and middle coxae, apical half in anterior surface of fore femur, base mostly in anterior surface of fore tibia, hind trochanter entirely, hind tibia with small dorsal macula subapically. Body hairs short and dense, silvery; setae on ovipositor sheath slightly curved, blackish brown. Wings hyaline, below pterostigma with pale smoky macula, boundary ill-defined, pterostigma and veins mostly blackish brown (Figure 3A).

Vertex less shiny; frontal area coarsely and densely punctured, interspaces smooth but weak; postocellar area mostly with sparse large punctures, interspaces narrow (Figure 3B); labrum and clypeus less shiny, punctures on labrum and clypeus sparse shallow and microsculpture fine (Figure 3C). Mesonotum less shiny, punctures smaller than those on head, interspaces smooth but indistinct and without microsculpture; center of mesoscutellum with sparse large punctures and fine microsculpture; basal half of mesoscutellar appendage rugose, apical half smooth, without distinct puncture; metascutellum somewhat shiny, punctures indistinct and microsculpture weak. Mesopleuron less shiny, mesepisternum with dense and coarse punctures, interspaces smooth but indistinct; anepimeron dull, with coarse wrinkles; anterior margin of katepimeron very

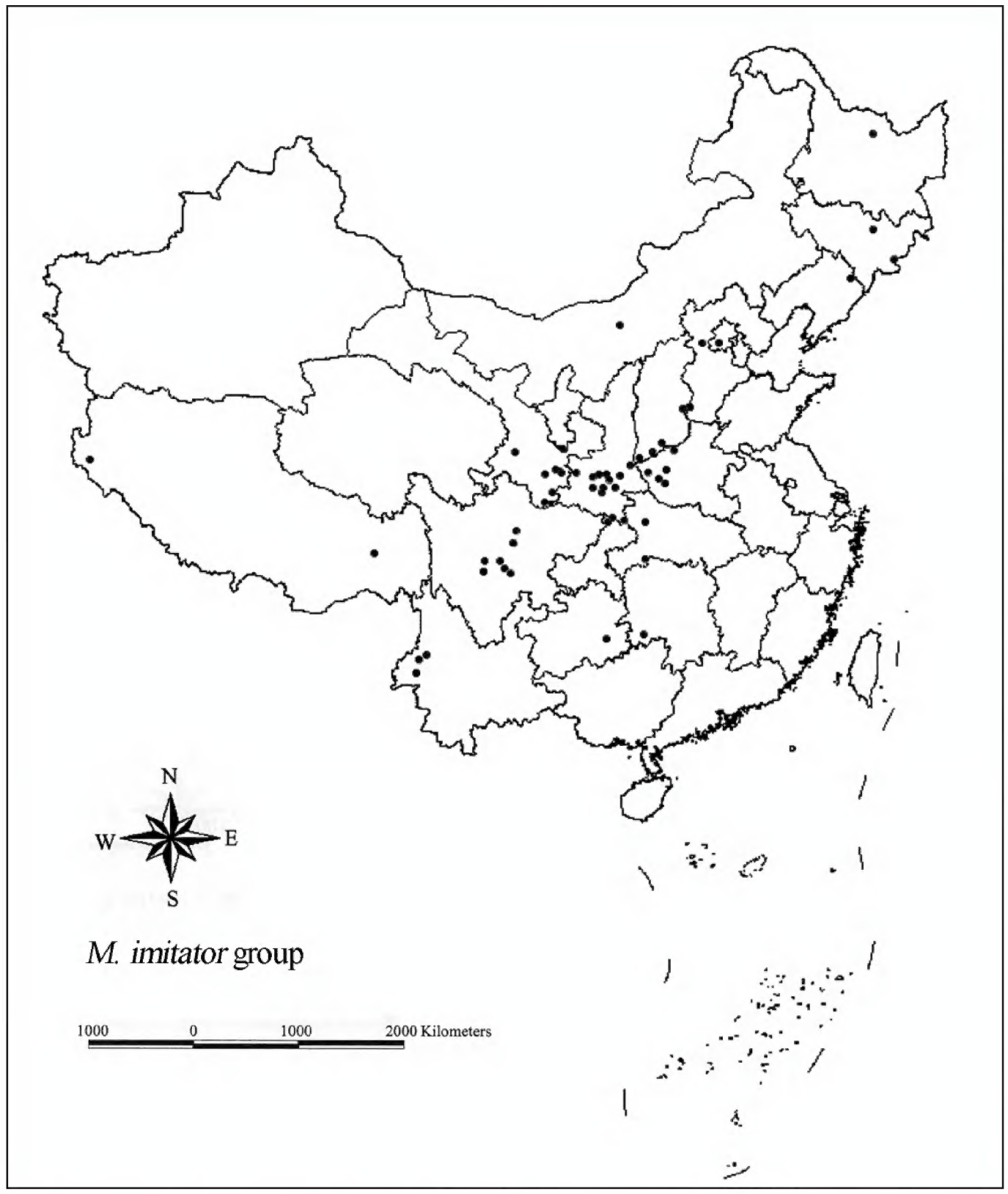

Figure 4. Geographical distribution map of *M. imitator* group in China.

smooth and shiny, without punctures or microsculpture, otherwise with sparse large shallow punctures, dorsal half with sparse coarse punctures; metepisternum dull, with minute punctures; metepimeron less shiny, most parts with sparse punctures and weak microsculpture; metepimeronal appendage platform-shaped, with some minute punctures (Figure 3E). All abdominal terga somewhat shiny, abdominal tergum 1 with sparse shallow punctures, with fine but distinct microsculpture submedially; other abdominal terga with minute and shallow punctures, microsculpture weak. Outer surface of hind coxa with somewhat dense and coarse punctures, ventral surface of hind coxa and outer surface of hind femur with sparse shallow punctures and fine microsculpture. Surface of ovipositor sheath coriaceous, with indistinct punctures and fine microsculpture.

Labrum elevated medially, anterior margin slightly truncate; clypeus weakly elevated, base slightly broader than distance between lower inner orbits of eyes, lateral sides distinctly convergent apically, anterior margin deeply incised to approximately 1/5 its length, lateral corners short and broad, lobe margin roundly subtriangular (Figure 3C); malar space linear, approximately 0.5× as broad as diameter of middle ocellus; frontal area and face flat, slightly higher than top of eyes in lateral view; middle fovea weak, lateral foveae shallow, short furrow-like; interocellar furrow shallow, postocellar furrow weak; POL: OOL: OCL = 9: 20: 11; postocellar area weakly elevated, 2.5× broader than long; lateral furrow somewhat narrow, divergent posteriorly; head narrowed behind eyes in dorsal view, occipital carina complete. Antenna rather robust, approximately 1.2× longer than head and thorax together (17:14), approximately 1.1× longer than abdomen (17: 15); antennomere 2 approximately 1.2× as long as breadth; antennomere 3 approximately 1.4× as long as antennomere 4 (39: 27), approximately 0.8× as long as antennomeres 4 and 5 together (39: 51), middle antennomeres not inflated, subapical antennomeres weakly compressed (Figure 3D). Mesoscutellum roundly elevated, with weak middle ridge or carina, as high as top of mesonotum in lateral view; mesoscutellar appendage with lower middle longitudinal carina; metascutellum with short and lower carina; posterodorsal platform of mesepimeron as broad as diameter of middle ocellus; metepimeronal appendage small platform-shaped; distance be-

tween cenchri twice breadth of a cenchrus; mesopleuron and metapleuron as shown in Figure 3E. Inner tibial spur of hind leg 0.6× length of metabasitarsus (5: 8); metabasitarsus slender, about 1.1× longer than following four tarsomeres together (8: 7); claw with inner tooth slightly shorter than outer tooth. Ovipositor sheath clearly longer than metabasitarsus (5: 4), apical sheath as long as basal sheath, setae on ovipositor sheath slightly curved in dorsal view, apical margin round in lateral view (Figure 3F). Fore wing with cross-vein cu-a joining cell 1M in basal 1/4, cross-vein 2r joining cell 2Rs in apical 1/4, cell 2Rs as long as cell $1R_1$, petiole of anal cell slightly shorter than cross-vein 1r-m and petiole of anal cell in hind wing 0.6× longer than cross-vein cu-a. Lancet narrow and long, with 21 serrulae (Figure 3G), serrulae clearly protruding and oblique platform-shaped, middle serrulae with 2 or 3 proximal and 9 or 10 distal teeth, subbasal teeth distinct and small, annular spine bands narrow, the 8^{th}–10^{th} serrulae as shown in Figure 3H.

Male. Unknown.

Type material. Holotype, ♀, China: Yunnan Province: Deqin County, Mountt Meri, 28°425'N, 98°805'E, 2700 m, 20.vi.2009, leg. Yihai Zhong, ethylacetate.

Host plants. Unknown.

Distribution. China (Yunnan).

Etymology. The specific name "*zejiani*" is derived from the name of Dr. Zejian Li who has made great contributions to the study of *Macrophya* systematics.

Discussion

The *Macrophya imitator* group orginally proposed by Liu et al. (2015) is the second largest of defined species group of *Macrophya* Dahlbom, 1835 in terms of known species. At present, there are 20 species belonging to this group in China, including the three new species described above: *M. bui* Wei & Li, 2012, *M. changbaina* Li, Liu & Heng, 2015, *M. circulotibialis* Li, Liu & Heng, 2015, *M. curvatisaeta* Wei & Li, 2010, *M. curvatitheca* Li, Liu & Heng, 2015, *M. flactoserrula* Chen & Wei, 2002, *M. funiushana* Wei, 1998, *M. imitatoides* Wei, 2007, *M. imitator* Takeuchi, 1937, *M. jiaozhaoae* Wei & Zhao, 2010, *M. kangdingensis* Wei & Li, 2012, *M. longlingensis* Li, Liu & Wei, sp. nov., *M.nieshuaiguoi* Li, Liu & Wei, sp. nov., *M. nigromaculata* Wei & Li, 2010, *M. omeialpina* Li, Jiang & Wei, 2018, *M. parimitator* Wei, 1998, *M. postscutellaris* Malaise, 1945, *M. semipunctata* Li, Liu & Wei, 2018, *M. weni* Wei, 1998 and *M. zejiani* Liu & Wei, sp. nov. The host plants of this group are unknown. The included key and geographical distribution map of the *M. imitator* group should facilitate the recognition and identification of the Chinese species.

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